718

Effect of Spray Materials on the Quality of Canned and Frozen Montmorency Cherries[a,b]

C. L. BEDFORD AND W. F. ROBERTSON
Department of Horticulture, Michigan State College, East Lansing, Mich.

A three-year study indicated that the spray materials, ferbam, nabam, copper, copper and wax and nabam and wax do not differ significantly in their effect on the quality of canned and frozen Montmorency cherries even though significant differences were found in the soluble solids contents of the canned cherries. Variation in the quality of processed cherries, however, does result from various cultural practices and climatic conditions during the growing season.

Investigations have shown that a wax emulsion applied to Montmorency cherry trees in combination with the usual fungicidal mixtures results in an increase in size of fruit of about 10 percent over those receiving no wax *(1, 2, 3, 5)* and therefore was considered of value for increasing fruit size and yield. However in 1947 cherry canners reported instances of inferior quality of processed cherries that could possibly be associated with the use of wax emulsion. They reported the cherries lacked color, were insipid, did not firm during cooling, were injured in pitting and retained spray residue. In 1949 Langer *(2)* and Langer and Fisher *(3)* found that ferbam and wax emulsion sprays increased the size, delayed ripening, lightened the color and decreased the soluble solids content of red cherries compared with sprays of proprietary coppers. Also the pitting characteristics were poorer and the drained weight of the canned fruit sprayed with either, or both, ferbam and wax emulsions was lower than those sprayed with proprietary copper. Swingle *(6)* has also reported that wax emulsions resulted in lower drained weights.

Since organic spray chemicals are now being widely used for controlling diseases of red cherries, it becomes important to know the effect of these materials on the yield and processing quality of the fruit. In 1949, 1950 and 1951 studies were made on Montmorency cherries to determine the relation of spray chemicals to the size, yield and soluble solids content of the harvested fruit and to the quality of the canned and frozen cherries. Results obtained on the canned and frozen cherries from the various treatments will be reported here. The results on the harvested fruit will be presented elsewhere.

EXPERIMENTAL METHODS

Montmorency cherries were obtained from 3 orchards in the Grand Traverse area and from one orchard in the Hart-Shelby area. In each orchard 4 pre-harvest fungicide applications were made. The fungicides used were ferbam,[c] nabam[d] and copper and were applied at the rates suggested by the manufacturer. All copper fungicide spray mixtures contained at least 70% metallic copper. The spraying operations were performed by each individual grower in the usual manner. Oil-wax emulsion[e] was included in the spraying schedules of insoluble copper and nabam in 3 orchards. The application was made at the time the cherries acquired the first tinge of pink. Five trees in each plot were selected and a mixed sample of fruit from these trees was obtained for processing at the time of commercial harvest. These cherries were immediately transported to the processing laboratory at East Lansing. On arrival they were placed in mesh bags, weighed and put in a 200-gallon soaking tank continually supplied with fresh tap water at the rate of approximately 25 gallons per hour and an average temperature of 42° F. (6° C.). The cherries were soaked for 12 hours, then removed, drained, weighed and sorted to remove damaged and light colored cherries. The sound fruit was pitted in a Dunkley cherry pitter of pilot plant capacity and the resulting loss in weight due to pits and juice recorded.

The pitted cherries were canned in No. 2 cherry enamel cans. Sixteen ounces of pitted cherries were filled in each can, covered with hot water, exhausted, processed in boiling water for 12 min., cooled and stored at 50° F. (10° C.). For freezing, the pitted cherries were packed with dry sugar (5 parts cherries plus one part sugar) in pint Marapak bags in cartons, frozen at —10° F. (—23° C.) and stored at 0° F. (—18° C.).

After 4 to 6 months' storage, the drained weight, soluble solids, tenderometer readings, color and grade of the canned and frozen cherries were determined. The canned cherries were removed from storage and allowed to come to room temperature, 68°-70° F. (20°-21° C.). The frozen cherries were thawed in warm water, 125°-130° F. (52°-54° C.) for about 20 minutes. Thawing was considered complete when the fruit reached a temperature of 50° F. (10° C.).

Drained weights and grades were determined according to the U. S. Standards for Grades for Canned and Frozen Red Sour (Tart) Pitted Cherries *(7, 8)*. The percent of soluble solids was determined with an Abbe refractometer. Tenderometer determinations were obtained with the Tenderometer using 150 g. samples. The readings of the canned cherries were made on scale 1 and those of the frozen cherries on scale 2.

Color was measured using an Evelyn colorimeter with the 515 mμ filter. As previously reported *(4)* the color in the canned cherries was found evenly distributed throughout the fruit and drained juice, and hence color determinations were made only on the juice. However, in the frozen cherries it was found that the relatively rapid thawing method did not result in even distribution of the color throughout the fruit and drained juice. Therefore, representative samples composed of fruit and drained juice were blended in a Waring Blendor with an equal amount of water for 3 minutes. The juice was first filtered through ED No. 192 filter paper, then through Reeve Angel No. 812 filter paper. A known aliquot was diluted with Sorenson's citrate-hydrochloric acid buffer of pH 3.4 to give an optical density within the sensitive range of the colorimeter.

RESULTS

Results obtained during the 1949, 1950 and 1951 seasons are summarized in Tables 1, 2 and 3.

---

[a] Journal Article No. 1326 from Michigan Agricultural Experiment Station, East Lansing.

[b] A report of work done under contract with the U. S. Department of Agriculture and authorized by the Research and Marketing Act. The contract is being supervised by the Eastern Regional Research Laboratory of the Bureau of Agriculture and Industrial Chemistry.

[c] Ferric dimethyldithiocarbamate.

[d] Disodium ethylenebisdithiocarbamate.

[e] Dowax 222.

Loss of fruit due to cullage was similar for all spray treatments in orchards A, B and C of the Grand Traverse area and no significant differences were found between 1950 and 1951. In orchard D the cullage loss was significantly higher than in the other orchards. The high cullage might be explained, in part, by the fact that orchard D was the last to be harvested and the cherries, being more mature than those obtained from the other orchards, were more susceptible to damage during handling. This orchard had also been highly fertilized with nitrogen. Another orchard in this area, under similar spray treatments but harvested earlier, showed cullage losses similar to those obtained for orchards A, B and C.

The percent of light colored cherries removed during the sorting operation varied from 3.7 to 24.0. There was no correlation between the amount of light-colored cherries and the spray treatments. In 1951 orchard C had a significantly higher amount of light-colored cherries than the other orchards.

Pit losses from the cherries sprayed with copper were significantly higher than those sprayed with copper and wax and nabam and wax. Although the average pit loss of the copper sprayed cherries was greater than that from the ferbam and nabam sprayed cherries, the difference was not significant and showed considerable variation between orchards and years. The pit losses were significantly higher in orchard D than in the other orchards and were significantly higher in 1951 than in 1949 or 1950. In 1951 it was observed that the cherries were not as firm as in previous years and did not pit as readily. The processors in the Grand Traverse area also reported difficulties in handling the cherries this year and the difficulties were similar to those occurring in 1947. An examination of the weather data showed that the growing seasons of 1947 and 1951 were characterized by lower than normal heat accumulations during the months of May, June and July. This, therefore, suggests that the poorer quality of the cherries, as indicated by softness and poorer pitting characteristics, may be attributed, in part, to low growing season temperatures. Since the softness of the fruit occurred in all spray treatments in 1951, it appears that the spray material played a minor role, if any, in the lack of firmness.

Canned and frozen cherries. The soluble solids contents of the copper-sprayed canned cherries were significantly higher than those sprayed with ferbam, copper and wax, or nabam and wax. These results are in agreement with those reported by Langer and Fisher *(3)* and Swingle *(6)*. The soluble solids content of the cherries from orchard C were significantly lower than those from the other orchards. In 1949 the soluble solids contents were significantly higher than in 1950 or 1951. This would be expected since the growing conditions in 1949 were more favorable.

All the canned cherries met the minimum drained weight requirements of the U. S. standards for canned

TABLE 1

Effect of spray treatments on fresh, canned and frozen Montmorency cherries

	Ferbam	Nabam	Copper	Copper and Wax	Nabam and Wax	F Value	L. S. D. 5%	L. S. D. 1%
Fresh Fruit								
Cull fruit %	5.2	7.2	6.3	6.6	7.1	1.13	....	....
Pit loss %	7.4	7.3	7.7	7.2	7.0	3.28*	0.4	0.6
Juice loss %	6.0	5.9	5.8	7.2	6.3	4.22*	0.8	1.1
Canned Fruit								
Soluble solids %	10.4	10.7	11.1	10.5	10.1	6.59**	0.5	0.6
Drained wt. oz.	13.8	14.1	14.1	13.9	13.8	2.5	....	....
Color Density	3.67	3.95	3.77	3.71	3.35	2.24	....	....
Tenderometer readings, lb./sq. in.	18.6	22.0	21.6	20.9	22.0	0.90	....	....
Frozen Fruit								
Drained wt. oz.	9.7	9.8	9.9	9.4	9.5	3.78	....	....
Color Density	5.45	5.96	5.85	5.28	5.16	1.45	....	....
Tenderometer readings, lb./sq. in.	47.9	48.1	49.8	49.1	49.3	1.26	....	....

*Significant 5% level.
**Significant 1% level.

TABLE 2

Effect of orchards on fresh, canned and frozen Montmorency cherries

	A	B	C	D	F Value	L. S. D. 5%	L. S. D. 1%
Fresh Fruit							
Cull fruit %	2.6	2.0	2.9	18.3	131.0**	2.3	3.3
Pit loss %	7.3	6.9	7.3	7.9	10.69**	0.4	0.5
Juice loss %	6.6	6.0	5.7	6.6	3.58*	0.7	1.0
Canned Fruit							
Soluble solids %	10.7	10.8	10.2	10.5	4.00*	0.4	0.6
Drained wt. oz.	13.9	13.9	14.0	14.0	0.10	....	....
Color Density	3.34	3.31	3.39	4.72	27.88**	0.42	0.62
Tenderometer readings, lb./sq. in.	19.5	16.9	25.6	22.1	7.75*	4.3	6.3
Frozen Fruit							
Drained wt. oz.	9.6	9.7	9.7	9.8	3.23	....	....
Color Density	5.11	4.92	5.35	6.78	10.71**	0.81	1.17
Tenderometer readings, lb./sq. in.	44.6	43.6	47.8	59.3	129.63**	2.1	3.0

*Significant 5% level.
**Significant 1% level.

TABLE 3
Effect of years on fresh, canned and frozen Montmorency cherries

	1949	1950	1951	F Value	L. S. D. 5%	L. S. D. 1%
Fresh Fruit						
Cull fruit %	....	6.7	6.2	0.59	....	....
Pit loss %	7.3	7.1	7.6	5.45**	0.3	0.4
Juice loss %	6.9	5.9	5.9	7.96**	0.6	0.9
Canned Fruit						
Soluble solids %	11.1	10.2	10.4	14.41**	0.4	0.5
Drained wt. oz.	13.9	13.9	14.1	1.6	....	....
Color density	....	3.30	4.08	36.00**	0.30	0.44
Tenderometer readings lb./sq. in.	....	22.8	19.3	7.08*	3.1	4.5
Frozen Fruit						
Drained wt. oz.	....	9.3	10.1	96.21**	0.2	0.3
Color density	....	4.28	6.80	103.57**	0.57	0.82
Tenderometer readings lb./sq. in.	....	45.3	52.4	123.94**	1.5	2.1

*Significant 5% level.
** Significant 1% level.

red, sour (tart) cherries *(7)*. No significant differences were found between spray treatments, orchards or years. The copper-sprayed cherries, however, averaged higher drained weights than the ferbam, copper and wax and nabam and wax sprayed cherries which is similar to results reported by Langer and Fisher *(3)* and Swingle *(6)*. The frozen cherries showed no significant differences in drained weights between sprays or orchards. The drained weights, however, were significantly higher in 1951 than in 1950. This trend was also observed in the canned cherries (Table 3), but the differences were not great enough to be significant.

Color densities were not significantly affected by the spray treatments but there was a tendency for the cherries sprayed with wax to have less color. The color densities of the cherries from orchard D were significantly higher than those from the other orchards. The greater color density may be attributed to the fact that the cherries were harvested at a more mature stage and that the percent sunshine and heat summation in the Hart-Shelby area was greater than in the Grand Traverse area. The color densities were also significantly greater in 1951 than in 1950. Increase in density was most pronounced in orchard D.

Tenderometer readings showed no significant differences between spray treatments but did show significant differences between orchards and years. The values obtained on the thawed frozen cherries were 2 to 3 times as great as those of the canned cherries. Although no definite explanation can be given, it appeared that in the freezing and thawing a greater disintegration of the cherry flesh occurred, resulting in the packing of the skins to give higher readings.

The quality of the processed fruit as judged by a taste panel showed no preference for any one spray treatment over another. There were, however, variations in the quality of the cherries from the different orchards and these variations differed from year to year. Investigations are now under way to determine the interaction of the fertilizers, soil moisture, temperature and time of harvest on the final quality.

SUMMARY

The effect of spray materials on the quality of canned and frozen Montmorency cherries was studied during 1949, 1950 and 1951.

The spray materials ferbam, nabam, copper, copper and one oil wax emulsion and nabam and one oil wax emulsion did not differ to any significant degree in their effect on the quality of the processed cherries. Significant differences between the spray materials only occurred in pit loss, juice loss and in the soluble solids contents of the canned cherries.

The cultural practices and climatic conditions generally resulted in greater variations in the processing quality of cherries than did the spray materials.

LITERATURE CITED

1. Langer, C. A. Effect of wax sprays on the yield of cherries, pears, and apples. *Proc. Amer. Soc. Hort. Sci.*, **51**, 191-195 (1948).
2. Langer, C. A. Effect of wax sprays on size, color, and composition of Montmorency cherries. *Ann. Rep. State Hort. Sci. Mich. for 1948*, **78**, 62-64 (1949).
3. Langer, C. A., and Fisher, V. J. Relation of wax emulsion and fungicidal sprays to size, color, and composition of fresh and processed Montmorency cherries. *Proc. Amer. Soc. Hort. Sci.*, **54**, 163-170 (1949).
4. Marshall, R. E., Robertson, W. F., Bedford, C. L., and Case, W. H. The effect of the length of soak on the quality of canned and frozen Montmorency cherries. *Food Technol.*, **5**, 116-118 (1951).
5. Neal, A. L., Barr, C. G., Gardner, V. R., Rasmussen, H. J., and Miller, E. J. Influence of oil-wax emulsion sprays on size of Montmorency cherries. *Jour. Agr. Res.*, **77**, 261-269 (1948).
6. Swingle, C. F. Wax spray on sour cherries in Wisconsin. *Proc. Amer. Soc. Hort. Sci.*, **55**, 159-162 (1950).
7. U. S. Standards for grades of canned red sour (tart) cherries. *Mimeo.* U.S.D.A., P.M.A. (June, 1949).
8. U. S. Standards for grades of frozen red sour (tart) cherries. *Mimeo.* U.S.D.A., P.M.A. (June, 1949).